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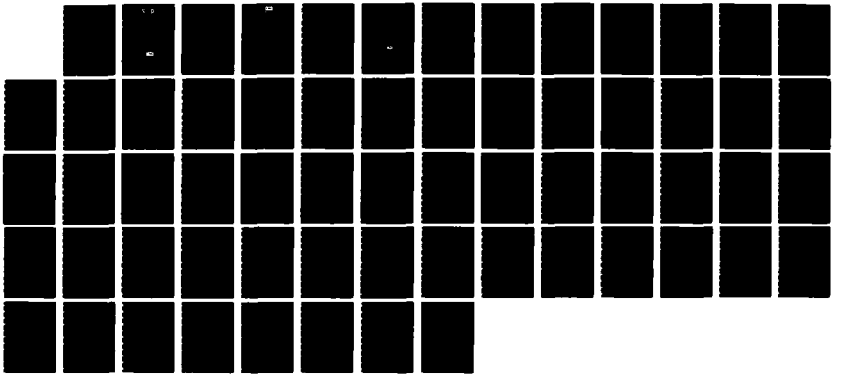

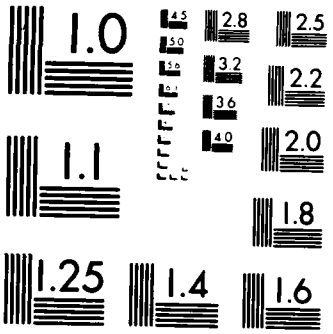

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RESEARCH MEMORANDUM

EVALUATION OF ALTERNATIVE COMPOSITIONS OF THE ARMED FORCES QUALIFICATION TEST (AFQT)

Gary E. Horne

N00014-83-C-0725

AD-A172 630

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SECURITY CLASSIFICATION OF THIS PAGE

AD-A172630

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) CRM 86-111	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Center for Naval Analyses 6b. OFFICE SYMBOL (If applicable) CNA	7a. NAME OF MONITORING ORGANIZATION Commandant of the Marine Corps (Code RDS)
6c. ADDRESS (City, State, and ZIP Code) 4401 Ford Avenue Alexandria, Virginia 22302-0268	7b. ADDRESS (City, State, and ZIP Code) Headquarters, Marine Corps Washington, D.C. 20380
8a. NAME OF FUNDING / ORGANIZATION Office of Naval Research 8b. OFFICE SYMBOL (If applicable) ONR	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N00014-83-C-0725
8c. ADDRESS (City, State, and ZIP Code) 800 North Quincy Street Arlington, Virginia 22217	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 65153M; PROJECT NO. C0031; TASK NO.; WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) Evaluation of Alternative Compositions of the Armed Forces Qualification Test (AFQT)	
12. PERSONAL AUTHOR(S) Gary E. Horne	
13a. TYPE OF REPORT Final 13b. TIME COVERED FROM TO	14. DATE OF REPORT (Year, Month, Day) May 1986 15. PAGE COUNT 60
16. SUPPLEMENTARY NOTATION	

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP
05	09	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
AFQT (armed forces qualification tests), Aptitude tests, ASVAB (armed services vocational aptitude battery), Data sets, Enlistment qualification, Intelligence tests, Marine Corps, Mental ability, Military personnel, MOS (Marine Corps occupational specialty), Occupations, Qualifications, Recruits, Scoring, Subtests, Test scores, Validation

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This paper evaluates seventeen ASVAB composites that were proposed as alternatives to replace the current AFQT. The alternatives are evaluated primarily on the basis of their predictive validity and their effects on the applicant pool.

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION Unclassified
22a NAME OF RESPONSIBLE INDIVIDUAL Lt.Col. G. W. Russell	22b TELEPHONE (Include Area Code) (202) 694-3491 22c OFFICE SYMBOL RDS-40

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted.

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1. Enclosure (1) is forwarded as a matter of possible interest.

2. The Armed Forces Qualification Test (AFQT) is used by the Armed Services as a measure of general trainability. AFQT scores are derived from various subtests contained within the Armed Services Vocational Aptitude Battery (ASVAB). One of the subtests that is used has caused repeated problems in the calibration of the AFQT. This Research Memorandum examines alternative subtests that could be used to redefine AFQT and eliminate this problem.

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Director
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EVALUATION OF ALTERNATIVE COMPOSITIONS OF THE ARMED FORCES QUALIFICATION TEST (AFQT)

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ABSTRACT

This paper evaluates seventeen ASVAB composites that were proposed as alternatives to replace the current AFQT. The alternatives are evaluated primarily on the basis of their predictive validity and their effects on the applicant pool.

EXECUTIVE SUMMARY

The Armed Services Vocational Aptitude Battery (ASVAB) is used by all branches of the Armed Services to measure the mental aptitudes of applicants for enlistment. Certain subtests from the ASVAB are combined to form the Armed Forces Qualification Test (AFQT). The AFQT is used to classify applicants into categories of general trainability. It is used to screen out lower ability applicants as well as to determine if enlistment guarantees and bonuses are to be awarded.

The current AFQT includes the Numerical Operations subtest, which is a speeded test. Scores on speeded subtests have been shown to be extremely sensitive to such factors as type font, answer sheet configuration, practice, and administrative procedures. In addition, the Numerical Operations subtest has little or no unique validity as a predictor of general trainability. Because of these problems, the services are evaluating ASVAB composites as candidates to replace the current AFQT. Seventeen alternatives were considered.

The purpose of this study was to determine which of these alternative AFQTs are the most desirable. The major criteria used in this determination were as follows:

- Predictive validity should be maximized.

- Negative effects on population subgroups such as females and blacks should be minimized.

Other criteria examined were the number of items and the content (i.e. constructs) of subtests included in each alternative composite.

Predictive validity was studied using final course grades in 34 Marine Corps Occupational Specialty (MOS) training courses. In examining the effects of the alternatives on population subgroups, two sets of data were studied independently. These data sets were the 1980 Youth Population and Marine Corps applicants for FY 1985. Both data sets generally lead to similar conclusions. Where differences do exist they seem attributable to the inflation of speeded test scores in the applicant data by practice effects or test taking strategy. For this reason, primary reliance is placed on results based on the 1980 Youth Population data set.

Based on the two major criteria, three alternatives (see table I) are clearly superior. The alternative consisting of Verbal + Arithmetic Reasoning + General Science + Math Knowledge best satisfies the evaluation criteria. This alternative:

- equals or exceeds the predictive validity of the current AFQT for all MOS clusters.

- is among the most satisfactory in terms of effects on the potential applicant pool.

TABLE I

MOST DESIRABLE ALTERNATIVE AFQTs

	Evaluation criteria									
			Qualifying rate[a]							
			At a percentile score of 31			At a percentile score of 50				
				Males			Males			
Composite	Contains speeded test?	Validity[b]	Females	Blacks	Whites[c]	Females	Blacks	Whites	Effective number of items	Order of preference
Current AFQT[d]	yes	.59	70.7	28.5	76.5	49.4	12.7	58.1	130[e]	--[f]
VE + AR + MK + GS	no	.61	69.0	30.3	78.0	48.0	15.6	60.9	130	1
VE + AR + MK	no	.61	69.4	30.3	76.9	48.1	15.3	59.3	105	2
2VE + 2AR + MK	no	.61	69.3	29.1	76.6	48.1	14.6	59.6	105	3

a. Percentage in 1980 Youth Population scoring at or above the indicated percentile score. Note that all other tables in this report follow convention and show disqualification rates, i.e., the percentage below a certain percentile score.
b. For 34 USMC training courses.
c. Includes Asians, Hispanics, etc.
d. VE + AR + NO/2
e. Use of half-point AFQT score provides 130 points of discrimination for current AFQT. Use of less than 130 will probably result in numerous AFQT percentile points that have no raw score equivalent.
f. Unsatisfactory.

- consists of a sufficient number of items to reduce the chances for test compromise.

- contains items in approximately equal portions from the verbal and math constructs.

RECOMMENDATION

It is recommended that a new AFQT consisting of the ASVAB subtests Verbal + Arithmetic Reasoning + General Science + Math Knowledge be adopted.

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BACKGROUND

The Armed Services Vocational Aptitude Battery (ASVAB) is used by all branches of the Armed Services to measure the mental aptitudes of applicants for enlistment. The ASVAB consists of 10 subtests which measure four factors or constructs [1]. The subtests that define each construct are listed in table 1 along with the number of items on each subtest.

TABLE 1

SUBTESTS DEFINING CONSTRUCTS ON THE ASVAB

Verbal	Math	Technical	Speed
GS	AR	AS	NO
WK	MK	MC	CS
PC		EI	

GS = General Science (25 items)
WK = Word Knowledge (35 items)
PC = Paragraph Comprehension (15 items)
AR = Arithmetic Reasoning (30 items)
MK = Math Knowledge (25 items)
AS = Auto/Shop Information (25 items)
MC = Mechanical Comprehension (25 items)
EI = Electronics Information (20 items)
NO = Numerical Operations (50 items)
CS = Coding Speed (84 items)

ASVAB subtests are combined to form aptitude composites, which indicate ability in different areas. One composite is the Armed Forces Qualification Test (AFQT) used by all services to help establish the qualifications of applicants for enlistment. The AFQT was formed to be an indicator of general trainability [2]. The AFQT also is used to screen out applicants at lower ability levels and to help determine eligibility for enlistment guarantees and bonuses [3].

The AFQT composite is calculated by adding the raw scores of the ASVAB subtests WK, PC, and AR, and one-half of the NO score (raw AFQT = VE + AR + NO/2, where VE is the sum of WK + PC). This raw score is converted into a percentile score and applicants are grouped into categories based on their percentile score. These categories are shown in table 2.

TABLE 2

AFQT CATEGORIES BY PERCENTILE SCORE RANGE

Category	Percentile score range
I	93-99
II	65-92
IIIA	50-64
IIIB	31-49
IVA	21-30
IVB, C	10-20
V	1-9

PROBLEM

The current AFQT includes Numerical Operations, which is a speeded test. Speeded tests are known to be sensitive to practice effects [4, 5] and thus coaching can easily improve scores. Other problems with speeded tests have been well-documented [6, 7, 8, 9]. These problems include the sensitivity of speeded test results to variations in answer sheets and differences in test administration procedures. It has been suggested that because of these problems, speeded tests should be used only in aptitude composites where they have unique validity [8].

The inclusion of the verbal and math constructs in the AFQT is essential since the AFQT was intended to be a measure of general trainability. However, the speed construct is not a measure of general trainability. Thus, an AFQT without speeded tests could still meet the criteria of a general trainability test, but without the problems that go along with speeded tests.

ALTERNATIVE AFQT DEFINITIONS

All four services were asked to submit ASVAB composites as candidates to replace the current AFQT. A total of 17 different ASVAB composites were submitted for consideration. These composites along with the current AFQT are presented in table 3.

TABLE 3

DEFINITIONS OF ALTERNATIVE ASVAB-AFQT COMPOSITES

CUR	=	Current AFQT	=	VE + AR + NO/2
ALT1	=	Alternative 1	=	VE + AR + GS + MK + MC + EI + AS
ALT2	=	Alternative 2	=	VE + AR + GS + MK + MC + EI
ALT3	=	Alternative 3	=	VE + AR + GS + MK + MC
ALT4	=	Alternative 4	=	VE + AR + GS + MK
ALT5	=	Alternative 5	=	VE + AR + GS
ALT6	=	Alternative 6	=	VE + AR
ALT7	=	Alternative 7	=	VE + AR + MK
ALT8	=	Alternative 8	=	VE + MK
ALT9	=	Alternative 9	=	VE + GS + MK
ALT10	=	Alternative 10	=	VE + AR + MC
ALT11	=	Alternative 11	=	GS + MK
ALT12	=	Alternative 12	=	2VE + 2AR + MK
ALT13	=	Alternative 13	=	VE + 2AR + GS
ALT14	=	Alternative 14	=	VE + MK + MC
ALT15	=	Alternative 15	=	AR + GS + AS
ALT16	=	Alternative 16	=	WK + 2PC + AR + GS + MK + EI + AS
ALT17	=	Alternative 17	=	VE + AR + GS + MK + EI + AS

Note: VE = WK + PC.

PURPOSE

The purpose of this study was to determine which of the proposed alternative AFQTs are the most desirable. The major criteria used in this determination were the predictive validity of the alternatives and the effect of the alternatives on population subgroups. The effects of the number of items and content of subtests were also considered in making the final recommendation.

PREDICTIVE VALIDITY

Table 4 shows the predictive validity of the alternative definitions against final course grades in Marine Corps Occupational Specialty (MOS) training courses. Reference [1] describes the samples and analysis in detail. The coefficients are population-wide estimates. The samples are grouped into MOS clusters, where each cluster had a different aptitude composite as the prerequisite. The validity for the total of the 34 samples (ranging in size from 153 to 2,508) was also computed. The total reasonably well reflects the distribution of occupational assignments of all Marine Corps accessions.

All alternatives met or exceeded the total predictive validity of the current AFQT. In addition, three of the alternative definitions met or exceeded the predictive validity of the current AFQT for all clusters. These alternatives were ALT4 (VE + AR + GS + MK), ALT7 (VE + AR + MK), and ALT12 (2VE + 2AR + MK). These three alternatives will also be known as ALTA, ALTB, and ALTC, respectively.

The next analysis is focused on determining how well the alternatives satisfy the second major criterion concerning the effects of the alternatives on population subgroups.

Table 4

VALIDITY OF ALTERNATIVE AFQT DEFINITIONS

	MOS Cluster						
Definition	MM	CL	EL	GT	CO	FA	Total
CUR	60	64	64	69	47	61	59
ALT1	66	61	68	70	50	64	62
ALT2	65	63	69	71	50	63	62
ALT3	64	63	68	71	50	63	62
ALT4	62	64	68	70	49	62	61
ALT5	62	62	66	69	48	61	60
ALT6	61	63	64	69	47	60	60
ALT7	61	65	67	70	48	61	61
ALT8	60	64	65	68	47	59	60
ALT9	61	63	66	69	48	60	60
ALT10	64	62	66	70	49	62	61
ALT11	59	62	68	68	48	60	59
ALT12	61	64	66	70	48	61	61
ALT13	62	63	67	70	48	62	61
ALT14	63	63	67	70	49	61	61
ALT15	65	56	66	67	48	63	59
ALT16	65	62	68	70	49	63	62
ALT17	66	62	68	70	49	64	62

MM = Mechanical Maintenance
CL = Clerical
EL = Electronics Repair
GT = General Technical
CO = Combat
FA = Field Artillery

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

SCORE DISTRIBUTIONS OF ALTERNATIVE AFQT COMPOSITES

1980 Youth Population

During the summer of 1980, the ASVAB was administered to a nationally representative sample of nearly 12,000 men and women, born in 1957 through 1964 [3]. The 1980 Youth Population (18- to 23-year-olds) came from this sample and was used to construct the current ASVAB score scale. Thus, the 1980 Youth Population was used in this study to determine the percentages of people in the population grouped by race and gender that attained the significant AFQT percentile scores of 10, 21, 31, 50, 65, and 93 on the alternative AFQTs. Appendix A contains the minimum raw score equivalents for these scores. These scores, especially 21, 31, and 50, are widely used by the services in making selection and classification decisions.

The score distributions for males and females and for Blacks and Whites were computed for each alternative. The category of Whites also includes Hispanics and other racial/ethnic groups. The alternatives were compared at percentile scores of 10, 21, 31, 50, 65, and 93, which represent the lowest scores for AFQT categories IVC, IVA, IIIB, IIIA, II, and I, respectively.

In this study, the results at percentile scores of 21, 31, and 50 will key the comparisons of alternative AFQTs. A percentile score of 21 is the minimum standard for acceptance into the Marine Corps. The

Marine Corps, as all services, attempt to limit the number of accessions with AFQT percentile scores below 31. Females with AFQT percentile below 50 are not accepted into the Marine Corps. The percentile score of 50 is also significant because it generally represents the minimum level at which enlistment guarantees and bonuses are given.

The alternatives were first compared for the 1980 Youth Population broken down by gender. Table 5 from [10] presents gender differences of subtest scores in the 1980 Youth Population. This table illustrates that technical subtests tend to favor males, while results are reasonably similar for males vs. females on the verbal and math subtests.

When the alternative AFQTs were compared, the results showed that alternatives with technical subtests (AS, MC, EI) have larger gender differences. The more technical subtests in an alternative, the larger the difference. At percentiles of 21, 31, and 50, more males qualify under virtually all of the alternatives when compared with the current AFQT. Fewer females qualify at the score of 50 (called the 50 level) on all but ALT6, ALT8, and ALT9. However, the three main alternatives, ALTA, ALTB, and ALTC, show results at the 50 level within 1.5 percent of the current AFQT. At this level the differences among these three were at most 0.1 percent. The effect on both males and females in the 1980 Youth Population of any of the six alternatives mentioned is minimal. Selected results follow in table 6. (Note that the percentages in table 6 and those following show the percentages <u>below</u> the indicated percentile scores.) Complete results can be found in appendix B.

TABLE 5

GENDER DIFFERENCES OF SUBTEST SCORES IN 1980 YOUTH POPULATION

Construct	Subtest	Mean		Standard deviation		Z-score difference[a]
		Male	Female	Male	Female	
Verbal	VE	36.934	37.637	10.938	10.217	-0.06
	GS	16.838	15.036	5.229	4.599	0.34
Math	AR	19.020	16.968	7.528	7.061	0.27
	MK	14.021	13.122	6.608	6.131	0.14
Technical	AS	17.210	11.337	5.453	3.795	1.08
	MC	16.177	12.093	5.442	4.373	0.75
	EI	13.091	10.001	4.240	3.615	0.73
Speed	NO	36.255	38.246	11.015	10.477	-0.18
	CS	44.173	51.142	16.258	16.539	-0.43

a. Male standard deviation used to compute z-scores.

TABLE 6

DISTRIBUTIONS OF SELECTED AFQT COMPOSITES FOR MALES AND FEMALES IN THE 1980 YOUTH POPULATION

	Percent scoring below percentile score					
	21		31		50	
AFQT Definition	Males	Females	Males	Females	Males	Females
CUR = VE + AR + NO/2	21.4	19.2	30.0	29.3	48.0	50.6
ALTA = VE + AR + GS + MK	19.9	20.6	28.5	31.0	45.2	52.0
ALTB = VE + AR + MK	19.7	19.4	29.4	30.6	46.6	51.9
ALTC = 2VE + 2AR + MK	20.3	20.3	29.8	30.7	46.4	51.9

Results were next broken down into the categories of Blacks and Whites. For the category of Whites, differences among the alternatives are minimal. For Blacks many alternatives are unfavorable; however, for six alternatives at least as many Blacks qualified as on the current AFQT. These are ALTA, ALTB, ALTC, ALT8, ALT9, and ALT11. Selected results follow in table 7. Complete results can be found in appendix B.

Distributions were next calculated using the 1980 Population males only. Because most accessions in all services are male, these results represent a realistic comparison of the alternatives. At the 21, 31, and 50 levels for both Blacks and Whites at least as many males qualify under any alternative than under the current AFQT, with the one exception of ALT8 at the 31 level. Thus, operationally, virtually all of the alternatives should result in a larger pool of qualified applicants. Selected results follow in table 8. Complete results can be found in appendix B.

Distributions were next calculated using the 1980 Population females only. At the 50 level, the best six alternatives for black females in order were ALT11, ALT8, ALT9, ALTA, ALTB, and ALT14. For White females the best was ALT8 followed by ALT6, ALT9, ALTC, and ALTA. Selected results follow in table 9. Complete results can be found in appendix B.

TABLE 7

DISTRIBUTIONS OF SELECTED AFQT COMPOSITES FOR BLACKS AND WHITES IN THE 1980 YOUTH POPULATION

	Percent scoring below percentile score					
	21		31		50	
AFQT Definition	Blacks	Whites	Blacks	Whites	Blacks	Whites
CUR = VE + AR + NO/2	56.1	14.7	70.5	23.2	87.5	43.2
ALTA = VE + AR + GS + MK	55.8	14.6	69.8	23.4	85.6	42.7
ALTB = VE + AR + MK	54.4	14.1	68.9	23.8	85.9	43.4
ALTC = 2VE + 2AR + MK	56.5	14.6	70.5	23.9	86.6	43.2

TABLE 8

DISTRIBUTIONS OF SELECTED AFQT COMPOSITES FOR
MALES ONLY IN THE 1980 YOUTH POPULATION

	Percent scoring below percentile score					
	21		31		50	
AFQT Definition	Blacks	Whites	Blacks	Whites	Blacks	Whites
CUR = VE + AR + NO/2	57.9	15.7	71.5	23.5	87.3	41.9
ALTA = VE + AR + GS + MK	56.1	14.2	69.7	22.0	84.4	39.1
ALTB = VE + AR + MK	55.4	14.2	69.7	23.1	84.7	40.7
ALTC = 2VE + 2AR + MK	57.1	14.6	70.9	23.4	85.4	40.4

TABLE 9

DISTRIBUTION OF SELECTED AFQT COMPOSITES FOR
FEMALES ONLY IN THE 1980 YOUTH POPULATION

	Percent scoring below percentile score					
	21		31		50	
AFQT Definition	Blacks	Whites	Blacks	Whites	Blacks	Whites
CUR = VE + AR + NO/2	54.3	13.6	69.6	22.8	87.7	44.6
ALTA = VE + AR + GS + MK	55.5	15.0	69.8	24.8	86.8	46.3
ALTB = VE + AR + MK	53.3	14.0	68.2	24.6	87.0	46.3
ALTC = 2VE + 2AR + MK	55.9	14.5	70.0	24.4	87.9	46.2

Marine Corps Applicants for Enlistment

ASVAB scores were obtained for all FY 1985 Marine Corps applicants. The original Marine Corps data contained records of all Marine Corps applicants who took the ASVAB in FY 1985. Only people who were applying for the first time in FY 1985 and only those applying for active duty (not reserve) status were used in this study. Those taking ASVAB forms 8 through 14 were used in this study. Tables 10 and 11 contain results for this sample for selected composites, while appendix B contains results for this sample for the first 15 alternative AFQT composites.

Results broken down by gender showed that slightly fewer males qualify at the 31 level, while slightly more qualify at the 50 level for the alternative definitions when compared to the current AFQT. This same comparison for females shows fewer females qualifying for all alternatives. The five alternatives which minimize the difference from the current AFQT at the 50 level for females are ALTA, ALTB, ALTC, ALT6, and ALT8. These five alternatives result in 7.5 to 9.5 percent fewer females qualifying.

Results for the Marine Corps sample broken down into the categories of Blacks and Whites showed that at the higher percentile levels (50, 65, and 93) most alternatives are close to the current AFQT for both groups. However, the differences (in the direction of fewer applicants qualifying on the alternative as opposed to the current AFQT) are marked at the 31 level for Black applicants. The alternatives which minimize these differences are ALTA, ALTB, ALTC, and ALT11.

TABLE 10

DISTRIBTUIONS OF SELECTED AFQT COMPOSITES FOR MALE AND FEMALE FY 1985 MARINE CORPS APPLICANTS

	Percent scoring below percentile score					
	21		31		50	
AFQT Definition	Males	Females	Males	Females	Males	Females
CUR = VE + AR + NO/2	8.4	3.8	18.0	11.5	51.1	31.1
ALTA = VE + AR + GS + MK	9.1	6.6	20.2	15.4	48.4	40.6
ALTB = VE + AR + MK	8.5	5.4	19.9	14.1	49.9	38.6
ALTC = 2VE + 2AR + MK	9.3	6.1	20.9	15.0	50.6	39.2

TABLE 11

DISTRIBUTIONS OF SELECTED AFQT COMPOSITES FOR BLACK AND WHITE FY 1985 MARINE CORPS APPLICANTS

	Percent scoring below percentile score					
	21		31		50	
AFQT Definition	Blacks	Whites	Blacks	Whites	Blacks	Whites
CUR = VE + AR + NO/2	17.9	5.0	34.6	12.3	72.7	42.3
ALTA = VE + AR + GS + MK	21.2	5.3	40.1	13.7	73.1	40.2
ALTB = VE + AR + MK	19.2	4.9	38.5	13.7	72.8	41.8
ALTC = 2VE + 2AR + MK	21.0	5.4	40.6	14.3	74.5	42.2

Summary of Results for Population Subgroups

Results for the population subgroups of females and Blacks for both the 1980 Youth Population and the Marine Corps FY 1985 applicants are summarized in rank order format in table 12. The most favorable alternatives for each subgroup are ranked from one to eight for each sample.

Results were also calculated for both the 1980 Youth Population and the Marine Corps sample after they were passed through a general technical filter. Details on this procedure and full results can be found in appendix C. A summary of selected results follows in table 13. The results were consistent with those from the unfiltered samples, i.e. table 12.

DIFFERENCES BETWEEN 1980 YOUTH POPULATION AND MARINE CORPS APPLICANTS

The results indicate that the FY 1985 Marine Corps applicants are systematically different from the 1980 Youth Population on the current AFQT. When the alternative AFQT composites are compared, the Marine Corps sample is similar to the 1980 Youth Population. The major difference between the current AFQT and the alternatives is the inclusion of a speeded test on the current AFQT and the absence of speeded tests on any of the alternatives. Thus, questions arise of how the Marine Corps sample differs from the 1980 Population on speeded tests and why.

TABLE 12

ALTERNATIVES RANKED BY FAVORABILITY TOWARD POPULATION SUBGROUPS

	1980 Youth Population		Marine Corps Applicants	
Rank	Females at 50 level	Blacks at 31 level	Females at 50 level	Blacks at 31 level
1	ALT8	ALT11	ALTB	ALT11
2	ALT9, ALT6	ALT8	ALT8	ALTB
3	--	ALTB	ALT6, ALTC	ALTA
4	ALTB, ALTC	ALTA	--	ALTC
5	--	ALT9	ALTA	ALT8
6	ALTA	ALTC	ALT9	ALT2
7	ALT14	ALT5	ALT13	ALT5
8	ALT13	ALT6, ALT14	ALT11	ALT13

TABLE 13

ALTERNATIVES RANKED BY FAVORABILITY TOWARD POPULATION SUBGROUPS
AFTER SAMPLES WERE EDITED BY THE GENERAL TECHNICAL FILTER

	1980 Youth Population		Marine Corps Applicants	
Rank	Females at 50 level	Blacks at 31 level	Females at 50 level	Blacks at 31 level
1	ALT8	ALT11	ALTB	ALT11
2	ALT6	ALT8	ALT8	ALTB
3	ALT9	ALTB	ALT6, ALTC	ALTA
4	ALTs A, B, C	ALTA	--	ALTC
5	--	ALT9	ALTA	ALT2
6	--	ALTC	ALT9	ALT5
7	ALT14	ALT5	ALT13	ALT13
8	ALT13	ALT6	ALT11	ALT8

The mean speeded subtest scores NO and CS were plotted against their highest correlates among power tests, AR and VE respectively in figures 1 and 2. These figures show that while the 1980 Population and the Marine Corps sample are similar at higher ability levels, at the lower ability levels the Marine Corps sample is disproportionately more able on the NO test. Focusing on figure 1, note that for Whites the two groups are virtually identical at an AR score of 18 and above, while for scores lower than 18 the difference between the groups increases as the AR score decreases. For Blacks these differences are even more pronounced. Figure 2 shows these differences are less pronounced for the CS test, which unlike NO is not in the AFQT.

Unless the Marine Corps applicants are systematically different from the 1980 Population, one possible explanation is that the speeded test scores for the Marine Corps applicants are artificially high. Speeded tests are subject to practice effects [4, 5]. Subjects in the 1980 Population had no reason to practice, while if recruiters have their applicants practice speeded tests, applicant samples such as the one used in this study should show higher than expected speeded test scores. This difference between the 1980 Youth Population and Marine Corps applicants suggests that the NO score scale is unstable and is another reason for eliminating speeded tests from the AFQT.

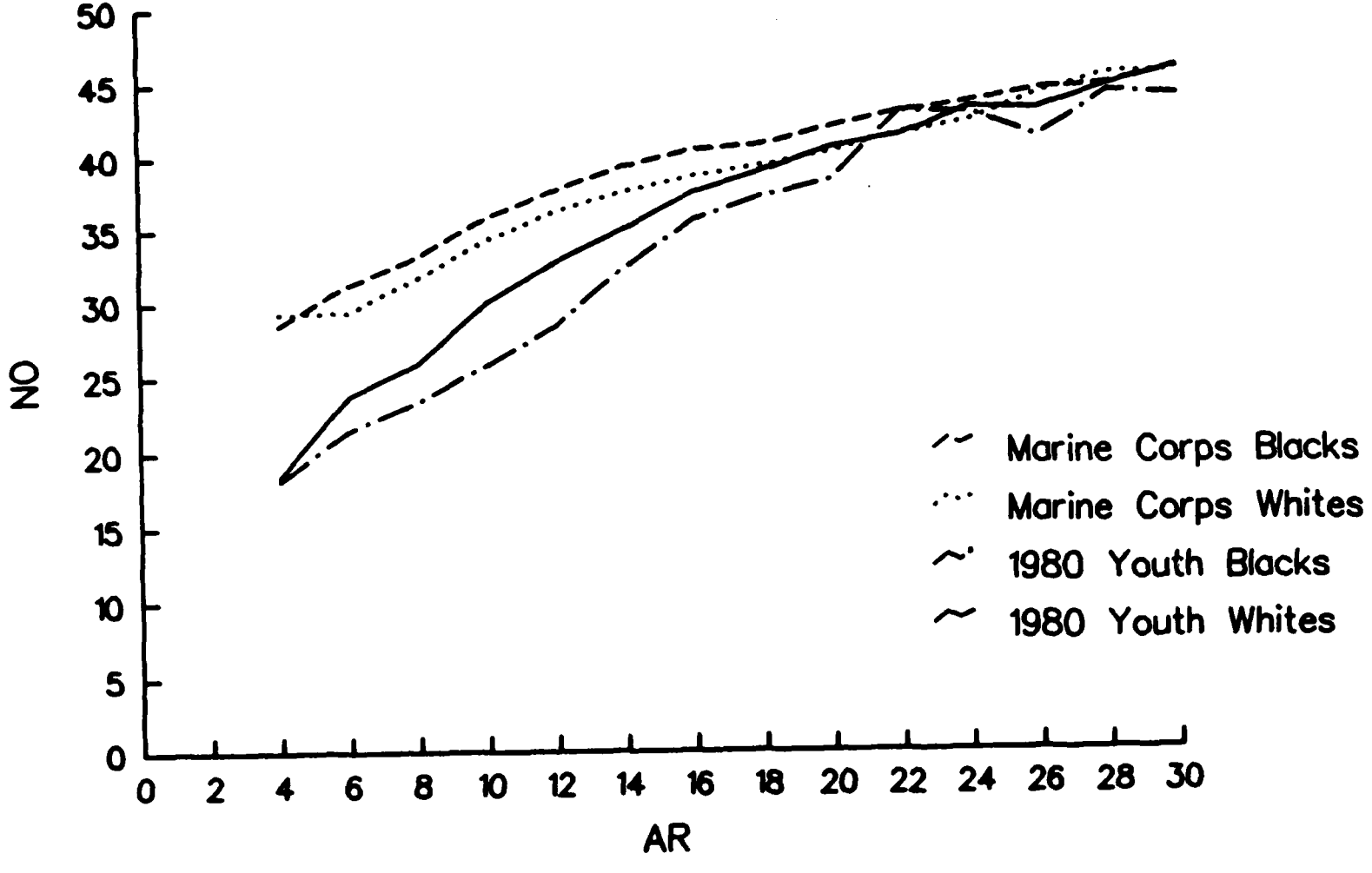

FIG. 1: MEAN NUMERICAL OPERATIONS (NO) PLOTTED AGAINST ARITHMETIC REASONING (AR) SCORES

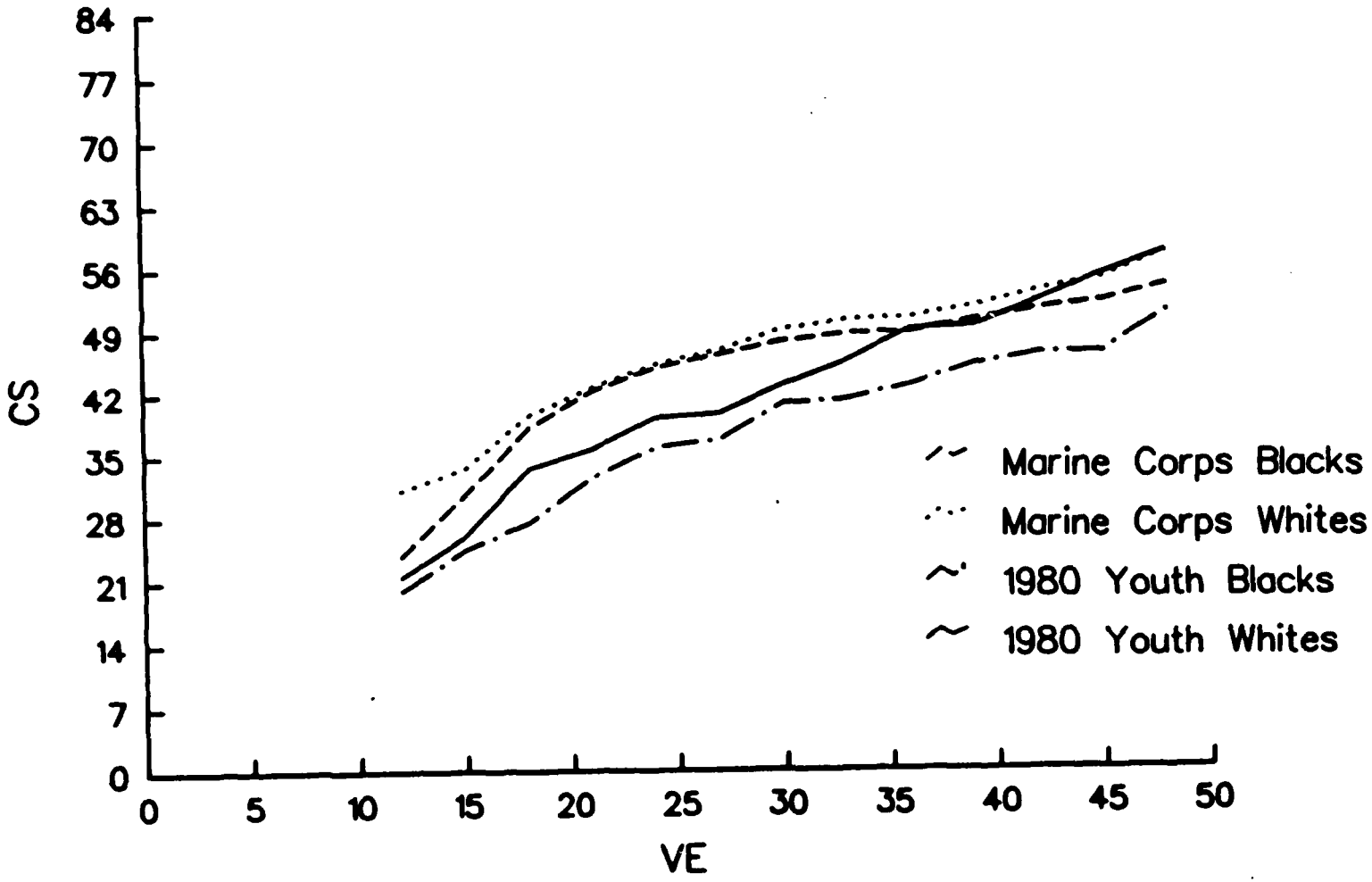

FIG. 2: MEAN CODING SPEED (CS) PLOTTED AGAINST VERBAL (VE) SCORES

DISCUSSION

Number of Items

For the current AFQT, 130 total items are scored (50 for VE, 30 for AR, 50 for NO). Because the NO score is halved, the scores range from 0 to 105 in half-point increments. For a given composite, the chance level score represents the expected score (rounded to the closest possible score) for people who randomly answered the items in that composite. The chance level score for the current AFQT is 26.5. The AFQT alternatives are composed of differing numbers of items, ranging from 200 items (chance score of 50) for ALT1 down to 50 items (chance score of 13) for ALT11. The total number of items and the maximum possible scores (due to differential subscale weighting) for each alternative AFQT are found in table 14. The chance level scores for each alternative AFQT are also shown along with the raw scores equivalent to percentile scores of 10, 21, and 31.

Table 14

CHANCE SCORE AND QUALIFYING RAW SCORES AT SELECTED PERCENTILE SCORES FOR ALTERNATIVE AFQT DEFINITIONS

Definition	Total Number of Items	Maximum Score[a]	Chance Score	Raw Score Equivalents at Percentile Scores of: 10	21	31
CUR	130	105	26.5	42.0	56.0	65.0
ALT1	200	200	50	69	90	105
ALT2	175	175	44	61	80	92
ALT3	155	155	39	54	71	83
ALT4	130	130	33	45	61	71
ALT5	105	105	26	39	53	61
ALT6	80	80	20	29	40	48
ALT7	105	105	26	36	48	57
ALT8	75	75	19	27	37	44
ALT9	100	100	25	36	49	58
ALT10	105	105	26	38	50	59
ALT11	50	50	13	16	20	23
ALT12	105	185	46	65	89	105
ALT13	105	135	34	48	64	75
ALT14	100	100	25	36	47	56
ALT15	80	80	20	26	34	39
ALT16	175	190	48	67	89	104
ALT17	175	175	44	61	80	94

a. The maximum score does not equal the total number of items when one or more subtests in the composite are given a weight other than 1.

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

The following are three advantages of having a longer AFQT:

- Because the AFQT score establishes an applicant's qualifications for enlistment, both the recruiter and applicant have a strong interest in seeing that the applicant achieves a qualifying score [2]. Evidence of past cheating on the AFQT is well-documented [11, 12, 13]. Thus, the advantage of a longer test lies in the fact that, in general, a longer test is harder to compromise.

- Different scores should occur because of differences in true ability rather than chance. In general, less variation occurs due to random chance for longer tests than shorter tests.

- Percentile scores, not raw scores, are used for the AFQT. Thus, tables of equivalent percentiles for raw scores must be calculated. A longer test will have fewer gaps in percentile scores; thus a more accurate transformation of scores occurs.

One disadvantage of a longer AFQT is the extra effort that is needed to score the questions, because immediate hand-scored AFQT

results are often calculated. Another disadvantage of having a longer AFQT is that the extra subtests included may measure constructs not appropriate for the AFQT, which leads to the next section on the content of the subtests in the composites.

Content of Subtests

It has been noted that the problems with speeded tests precipitated the desire to seek alternatives to the current AFQT. Thus, none of the alternatives included speeded tests. The portion of the proposed AFQT alternatives represented by the remaining three constructs differs widely among the alternatives and could be used as a criterion for determining which alternatives were most desirable. No definite standards exist, although reasonable standards might be the following:

- Include the verbal and math constructs in approximately equal portions because they both are important general measures for trainability.

- Include the technical construct to a lesser degree in light of its negative impact on females, and exclude the speed construct because of the problems speeded tests incur.

Table 15 contains the percentage of points possible by construct for each alternative.

Table 15

TOTAL POINTS POSSIBLE AND PERCENTAGE OF POINTS POSSIBLE BY CONSTRUCT FOR ALTERNATIVE AFQT DEFINITIONS

Definition	Total Points Possible	Percentage by Construct[a]			
		Verbal	Math	Technical	Speed
CUR	105	48	29	--	24
ALT1	200	38	28	35	--
ALT2	175	43	31	26	--
ALT3	155	48	35	16	--
ALT4	130	58	42	--	--
ALT5	105	71	29	--	--
ALT6	80	63	38	--	--
ALT7	105	48	52	--	--
ALT8	75	67	33	--	--
ALT9	100	75	25	--	--
ALT10	105	48	29	24	--
ALT11	50	50	50	--	--
ALT12	185	54	46	--	--
ALT13	135	56	44	--	--
ALT14	100	50	25	25	--
ALT15	80	31	38	31	--
ALT16	190	47	29	24	--
ALT17	175	43	31	26	--

a. Percentages will not always add to 100 because of rounding

```
CUR   = VE + AR + NO/2
ALT1  = VE + AR + GS + MK + MC + EI + AS
ALT2  = VE + AR + GS + MK + MC + EI
ALT3  = VE + AR + GS + MK + MC
ALT4  = VE + AR + GS + MK
ALT5  = VE + AR + GS
ALT6  = VE + AR
ALT7  = VE + AR + MK
ALT8  = VE + MK
ALT9  = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS
```

CONCLUSIONS AND RECOMMENDATION

In considering alternative AFQT composites, the following two major criteria were used in determining their desirability:

- Predictive validity should be maximized, or at least equal the current AFQT for each MOS cluster.

- Negative effects on population subgroups such as females and blacks should be minimized.

Following these two major criteria, ALT4 (VE + AR + GS + MK), ALT7 (VE + AR + MK), and ALT12 (2VE + 2AR + MK) appear to be the most desirable alternatives to the current AFQT. These three alternatives are the only ones that meet or exceed the predictive validity of the current AFQT for all MOS clusters. Also, these three alternatives are among the most satisfactory in terms of their effect on the applicant pool, both as a whole and with regard to females and Blacks. These observations follow for both the 1980 Youth Population and the FY 1985 Marine Corps applicants.

To choose the most desirable among these three alternatives, this third criteria was examined: the number of test items should be maximized, primarily to reduce the chance for compromise. Thus, the recommended alternative is ALT4 (VE + AR + GS + MK).

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APPENDIX A

MINIMUM RAW SCORE EQUIVALENTS FOR SIGNIFICANT PERCENTILE SCORES

APPENDIX A

MINIMUM RAW SCORE EQUIVALENTS FOR SIGNIFICANT PERCENTILE SCORES

Table A-1 contains the minimum raw score required to achieve the minimum percentile scores for the various AFQT categories. These minimum raw scores were calculated for the current AFQT and each alternative by taking the unsmoothed cumulative percentages by score of the 1980 Youth Population rounded to the nearest whole number.

Table A-1

MINIMUM RAW SCORE EQUIVALENTS FOR SIGNIFICANT PERCENTILE SCORES

	Percentile Score					
Definition	10	21	31	50	65	93
CUR	42.0	56.0	65.0	78.0	85.5	99.0
ALT1	69	90	105	128	144	176
ALT2	61	80	92	113	128	156
ALT3	54	71	83	101	114	140
ALT4	45	61	71	87	98	121
ALT5	39	53	61	75	82	98
ALT6	29	40	48	58	65	76
ALT7	36	48	57	71	80	99
ALT8	27	37	44	53	59	71
ALT9	36	49	58	69	77	93
ALT10	38	50	59	72	81	96
ALT11	16	20	23	29	34	45
ALT12	65	89	105	129	145	175
ALT13	48	64	75	92	104	127
ALT14	36	47	56	67	75	91
ALT15	26	34	39	49	55	71
ALT16	67	89	104	126	140	169
ALT17	61	80	94	114	127	156

CUR = VE + AR + NO 2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

APPENDIX B

DETAILED RESULTS

APPENDIX B

DETAILED RESULTS

Partial results for the 1980 Youth Population and FY 1985 Marine Corps applicants were presented in tables 5 through 10 of the main text. Tables B-1 through B-4 contain complete results for the 1980 Population. Tables B-1 and B-2 contain results broken down by gender and race, respectively. Tables B-3 and B-4 contain results for males only and females only, respectively. Tables B-5 and B-6 contain results for the FY 1985 Marine Corps applicants by gender and race, respectively.

Table B-1

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS FOR 1980 YOUTH POPULATION

Weighted N = 25,409,021
(12,891,155 males and 12,517,866 females)

	Males and Females - Percent scoring below percentile score											
	10		21		31		50		65		93	
Def.	M	F	M	F	M	F	M	F	M	F	M	F
CUR	10.5	8.3	21.4	19.2	30.0	29.3	48.0	50.6	61.9	66.9	90.2	92.8
ALT1	8.0	10.3	16.9	23.2	24.1	36.2	39.2	59.6	53.1	75.9	85.6	98.6
ALT2	8.6	10.0	18.3	22.5	25.7	33.6	41.7	56.4	55.8	73.1	86.0	97.5
ALT3	8.7	9.4	18.4	21.6	27.3	33.6	42.7	54.4	56.3	70.9	87.0	96.4
ALT4	9.1	8.7	19.9	20.6	28.5	31.0	45.2	52.0	58.9	68.1	89.2	95.3
ALT5	9.7	9.0	20.1	20.5	27.8	30.3	45.2	53.5	57.6	67.8	88.3	95.0
ALT6	9.4	8.2	19.5	19.3	29.9	30.8	45.4	50.6	60.6	67.6	88.8	92.4
ALT7	9.9	8.6	19.7	19.4	29.4	30.6	46.6	51.9	59.7	66.6	89.5	94.1
ALT8	10.5	8.2	21.1	18.9	30.1	29.0	46.9	48.5	61.7	64.0	90.1	93.4
ALT9	9.5	8.4	20.2	19.2	29.7	30.6	45.4	50.6	60.0	66.3	89.1	95.1
ALT10	9.0	9.0	18.0	20.7	26.2	32.1	41.9	54.5	56.8	72.2	87.4	96.6
ALT11	8.6	10.2	17.1	21.1	25.7	31.5	43.8	53.8	58.3	67.8	85.3	95.1
ALT12	9.8	8.6	20.3	20.3	29.8	30.7	46.4	51.9	60.2	67.5	90.3	94.1
ALT13	9.1	9.0	19.6	20.8	28.3	32.3	44.5	53.3	58.1	69.8	89.1	95.8
ALT14	9.7	9.2	18.8	20.4	27.7	33.3	42.5	53.2	56.6	69.2	88.1	96.5
ALT15	6.5	10.2	14.6	25.7	20.3	37.5	35.6	63.3	47.7	77.0	85.8	99.1
ALT16	8.6	10.0	18.1	21.8	25.9	34.2	41.0	57.2	54.8	73.4	86.0	98.0
ALT17	8.3	10.2	17.3	22.5	25.2	35.4	40.3	57.9	53.7	73.5	86.4	98.6

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

Table B-2

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS FOR 1980 YOUTH POPULATION

Weighted N = 25,409,021
(3,470,265 Blacks and 21,938,756 Whites)

	Blacks and Whites - Percent scoring below percentile score											
	10		21		31		50		65		93	
Def.	B	W	B	W	B	W	B	W	B	W	B	W
CUR	31.8	5.9	56.1	14.7	70.5	23.2	87.5	43.2	93.5	59.7	99.4	90.3
ALT1	33.2	5.3	59.1	13.8	74.9	22.9	88.3	43.1	94.7	59.5	99.3	90.9
ALT2	32.8	5.6	59.0	14.3	71.8	22.9	87.5	42.8	94.3	59.6	99.2	90.5
ALT3	31.9	5.5	56.9	14.1	72.0	23.8	87.2	42.3	93.6	58.7	99.2	90.4
ALT4	30.5	5.5	55.8	14.6	69.8	23.4	85.6	42.7	92.3	58.8	99.4	91.1
ALT5	32.0	5.8	57.2	14.5	71.2	22.4	87.2	43.3	92.9	57.9	99.5	90.4
ALT6	29.7	5.5	55.1	13.7	71.4	23.8	85.8	41.9	93.2	59.5	99.3	89.2
ALT7	30.8	5.9	54.4	14.1	68.9	23.8	85.9	43.4	91.8	58.6	99.4	90.6
ALT8	31.0	5.9	53.7	14.7	67.9	23.5	82.8	42.2	89.9	58.6	99.0	90.5
ALT9	30.3	5.6	54.2	14.2	70.3	23.8	84.0	42.2	91.3	58.7	99.1	90.9
ALT10	32.1	5.4	57.0	13.4	71.9	22.4	88.0	41.8	94.9	59.5	99.6	90.7
ALT11	29.4	6.2	51.6	13.9	64.3	22.9	82.8	43.3	90.7	58.6	98.6	88.8
ALT12	31.2	5.8	56.5	14.6	70.5	23.9	86.6	43.2	92.6	59.3	99.4	91.0
ALT13	32.0	5.4	56.7	14.4	72.2	23.7	87.0	42.8	93.4	59.2	99.4	91.2
ALT14	32.6	5.8	55.3	14.0	71.4	23.9	85.4	41.8	92.7	58.1	99.5	91.1
ALT15	30.9	4.8	60.9	13.6	73.7	21.7	89.3	42.9	94.3	57.0	99.5	91.2
ALT16	33.2	5.5	57.4	14.0	73.3	23.1	87.5	42.9	93.9	59.2	99.2	90.8
ALT17	33.7	5.4	58.0	13.8	74.1	23.3	87.8	42.9	94.1	58.6	99.2	91.3

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

Table B-3

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS FOR 1980 YOUTH POPULATION
MALES ONLY

Weighted N = 12,891,155
(1,733,046 Blacks and 11,158,109 Whites)

	Blacks and Whites - Percent scoring below percentile score											
	10		21		31		50		65		93	
Def.	B	W	B	W	B	W	B	W	B	W	B	W
CUR	36.1	6.5	57.9	15.7	71.5	23.5	87.3	41.9	92.9	57.1	99.1	88.8
ALT1	32.6	4.1	54.6	11.0	70.4	16.9	84.1	32.2	91.9	47.1	98.6	83.6
ALT2	33.9	4.7	56.4	12.4	69.4	19.0	84.6	35.0	91.9	50.2	98.5	84.0
ALT3	33.8	4.8	55.3	12.6	70.2	20.6	85.0	36.1	91.7	50.8	98.5	85.2
ALT4	33.0	5.4	56.1	14.2	69.7	22.0	84.4	39.1	91.1	53.8	98.9	87.7
ALT5	34.9	5.8	56.8	14.4	70.6	21.2	85.0	39.0	91.2	52.4	98.9	86.7
ALT6	33.5	5.6	55.3	13.9	71.2	23.5	84.2	39.3	92.0	55.8	98.8	87.2
ALT7	34.5	6.1	55.4	14.2	69.7	23.1	84.7	40.7	91.3	54.8	99.0	88.0
ALT8	35.4	6.6	55.6	15.7	69.1	24.0	82.7	41.4	90.1	57.3	98.8	88.7
ALT9	33.8	5.8	54.7	14.8	70.7	23.3	83.4	39.5	90.5	55.3	98.7	87.6
ALT10	35.0	5.0	55.7	12.2	69.5	19.5	84.8	35.2	92.9	51.2	99.1	85.6
ALT11	29.4	5.4	50.0	11.9	63.4	19.8	82.7	37.8	90.0	53.4	97.5	83.4
ALT12	34.8	5.9	57.1	14.6	70.9	23.4	85.4	40.4	91.6	55.3	99.0	89.0
ALT13	33.8	5.3	56.3	13.9	71.1	21.7	85.0	38.2	91.6	52.8	98.9	87.5
ALT14	35.9	5.6	55.2	13.2	69.4	21.2	83.5	36.1	90.5	51.3	98.9	86.4
ALT15	27.3	3.3	53.2	8.6	66.8	13.1	84.9	27.9	90.8	41.0	98.9	83.7
ALT16	33.5	4.7	55.4	12.3	70.7	18.9	84.0	34.3	91.3	49.1	98.4	84.1
ALT17	33.0	4.4	54.6	11.5	70.8	18.1	84.3	33.5	91.4	47.8	98.4	84.5

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

Table B-4

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS FOR 1980 YOUTH POPULATION
FEMALES ONLY

Weighted N = 12,517,866
(1,737,219 Blacks and 10,780,647 Whites)

	Blacks and Whites - Percent scoring below percentile score											
	10		21		31		50		65		93	
Def.	B	W	B	W	B	W	B	W	B	W	B	W
CUR	27.6	5.2	54.3	13.6	69.6	22.8	87.7	44.6	94.1	62.5	99.7	91.7
ALT1	33.8	6.6	63.7	16.7	79.3	29.2	92.5	54.3	97.6	72.4	100.0	98.4
ALT2	31.7	6.5	61.7	16.2	74.3	27.0	90.5	50.9	96.6	69.3	100.0	97.1
ALT3	30.0	6.1	58.5	15.6	73.8	27.1	89.5	48.8	95.5	66.9	100.0	95.8
ALT4	28.0	5.6	55.5	15.0	69.8	24.8	86.8	46.3	93.6	64.0	100.0	94.5
ALT5	29.1	5.7	57.6	14.6	71.8	23.6	89.4	47.7	94.5	63.5	100.0	94.2
ALT6	25.8	5.3	54.9	13.6	71.5	24.2	87.4	44.6	94.4	63.3	99.9	91.2
ALT7	27.1	5.6	53.3	14.0	68.2	24.6	87.0	46.3	92.4	62.5	99.9	93.2
ALT8	26.6	5.2	51.8	13.6	66.7	23.0	82.9	43.0	89.7	59.9	99.3	92.4
ALT9	26.9	5.5	53.7	13.6	69.8	24.3	84.6	45.1	92.1	62.2	99.5	94.4
ALT10	29.2	5.7	58.3	14.6	74.2	25.4	91.1	48.6	96.8	68.2	100.0	96.0
ALT11	29.4	7.1	53.2	15.9	65.2	26.0	82.9	49.1	91.4	64.0	99.7	94.4
ALT12	27.5	5.6	55.9	14.5	70.0	24.4	87.9	46.2	93.6	63.3	99.9	93.1
ALT13	30.3	5.6	57.1	15.0	73.3	25.8	89.1	47.6	95.1	65.8	100.0	95.1
ALT14	29.3	5.9	55.3	14.8	73.4	26.8	87.3	47.7	94.8	65.1	100.0	95.9
ALT15	34.4	6.3	68.5	18.8	80.6	30.6	93.7	58.4	97.8	73.6	100.0	99.0
ALT16	32.8	6.3	59.4	15.8	75.8	27.5	91.1	51.7	96.5	69.6	100.0	97.7
ALT17	34.4	6.3	61.4	16.2	77.4	28.6	91.3	52.6	96.7	69.8	100.0	98.4

CUR = VE + AR + NO 2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

Table B-5

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS
FOR MARINE CORPS FY85 APPLICANTS

N = 61,247
(55,548 males and 5,699 females)

Males and Females - Percent scoring below percentile score

	10		21		31		50		65		93	
Def.	M	F	M	F	M	F	M	F	M	F	M	F
CUR	1.4	0.5	8.4	3.8	18.0	11.5	51.1	31.1	70.7	60.0	96.5	95.8
ALT1	1.5	1.1	7.9	9.7	18.3	22.6	44.0	57.3	64.2	79.1	95.3	99.4
ALT2	1.7	1.0	8.7	8.5	18.4	18.5	45.8	49.6	66.4	74.4	95.5	98.6
ALT3	1.8	1.0	8.8	7.9	19.9	17.8	46.3	45.5	66.1	70.0	96.0	98.5
ALT4	1.5	0.6	9.1	6.6	20.2	15.4	48.4	40.6	67.8	65.7	97.4	98.3
ALT5	1.7	0.7	9.7	7.3	20.0	16.2	50.3	45.0	66.5	65.7	96.5	97.4
ALT6	1.5	0.6	8.9	6.0	21.6	15.9	49.8	39.2	70.2	65.8	96.6	96.5
ALT7	1.6	0.6	8.5	5.4	19.9	14.1	49.9	38.6	68.7	63.8	97.7	98.1
ALT8	1.5	0.4	9.3	5.2	22.9	14.4	50.8	39.1	69.6	62.0	96.4	96.5
ALT9	1.5	0.5	9.4	6.2	22.9	16.9	48.0	41.3	67.3	65.0	96.3	97.4
ALT10	1.9	1.1	8.4	7.8	19.1	17.7	46.3	46.6	67.3	72.7	95.8	98.3
ALT11	2.4	1.6	9.9	8.9	18.3	16.2	43.9	42.4	63.6	63.7	95.3	97.5
ALT12	1.6	0.6	9.3	6.1	20.9	15.0	50.6	39.2	70.2	66.0	97.8	98.1
ALT13	2.0	1.0	9.3	7.3	20.1	16.7	47.7	41.5	67.9	67.4	97.9	98.7
ALT14	1.9	1.0	8.5	7.2	21.8	18.6	47.0	46.1	66.4	70.0	95.7	98.2
ALT15	1.9	2.8	8.1	13.7	16.0	25.6	40.2	59.9	57.2	79.0	96.3	99.8

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS

Table B-6

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS
FOR MARINE CORPS FY85 APPLICANTS

N = 61,247
(13,961 Blacks and 47,286 Whites)

	Blacks and Whites - Percent scoring below percentile score											
	10		21		31		50		65		93	
Def.	B	W	B	W	B	W	B	W	B	W	B	W
CUR	3.1	0.8	17.9	5.0	34.6	12.3	72.7	42.3	88.6	64.2	99.4	95.5
ALT1	4.2	0.6	22.1	3.9	44.3	11.1	77.9	35.6	91.4	58.0	99.7	94.4
ALT2	4.5	0.8	22.1	4.8	41.0	11.7	75.2	37.6	90.0	60.4	99.6	94.6
ALT3	4.8	0.8	21.8	4.8	42.4	13.0	74.5	37.8	89.1	59.8	99.6	95.2
ALT4	3.8	0.7	21.2	5.3	40.1	13.7	73.1	40.2	88.1	61.6	99.7	96.8
ALT5	4.4	0.8	22.8	5.5	41.1	13.3	76.8	41.8	88.6	59.9	99.6	95.7
ALT6	3.6	0.8	20.5	5.1	42.5	14.7	74.8	41.2	90.0	63.8	99.5	95.7
ALT7	4.0	0.8	19.2	4.9	38.5	13.7	72.8	41.8	87.8	62.4	99.7	97.2
ALT8	3.6	0.7	19.6	5.8	40.9	16.5	71.6	43.2	86.4	63.8	99.4	95.6
ALT9	3.7	0.7	21.0	5.7	42.6	16.4	71.4	40.3	86.6	61.3	99.5	95.4
ALT10	5.0	0.9	21.1	4.5	42.2	12.1	76.5	37.5	91.2	60.9	99.7	94.9
ALT11	5.8	1.3	21.4	6.4	34.8	13.1	66.0	37.2	82.8	58.0	99.3	94.4
ALT12	3.9	0.8	21.0	5.4	40.6	14.3	74.5	42.2	89.4	64.0	99.7	97.2
ALT13	5.1	0.9	22.2	5.3	41.4	13.4	74.7	39.0	89.5	61.5	99.7	97.5
ALT14	4.9	0.9	20.6	4.8	44.1	14.8	74.2	38.9	88.8	60.2	99.6	94.8
ALT15	6.1	0.8	24.6	3.9	42.9	9.2	78.1	31.4	90.0	50.2	99.8	95.7

CUR = VE + AR + NO 2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS

APPENDIX C

RESULTS WITH GENERAL TECHNICAL FILTER

APPENDIX C

RESULTS WITH GENERAL TECHNICAL FILTER

The Marine Corps General Technical ASVAB Composite (GT) is the sum of VE, AR, and MC. A GT score of 80 is one standard deviation below the 1980 Youth Population mean.

To simulate the GT screen, which male Marine Corps applicants must pass through in addition to the AFQT, both the 1980 Population and the Marine Corps sample were passed through a GT filter. Any person, including females, with a standard GT score below 80 was edited out.

Results for the 1980 Population are contained in tables C-1, C-2, and C-3. Table C-1 contains results by gender and table C-2 contains results by race. Table C-3 (males only) was created because over 90 percent of Marine Corps accessions are male; thus it represents a close to operational situation for the Marine Corps. Results for the Marine Corps sample can be found in tables C-4 and C-5. Table C-4 contains results by gender, and table C-5 contains results by race.

All results are consistent with the results without the GT filter located in tables B-1 through B-6. Using the same criteria for evaluating alternatives, the results in tables C-1 through C-5 indicate the same recommendations as before: ALTA, ALTB, and ALTC are the most desirable alternatives to the current AFQT.

Table C-1

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS
FOR 1980 YOUTH POPULATION WITH GT FILTER

Weighted N = 22,449,523
(11,391,754 males and 11,057,769 females)

	Males and Females - Percent scoring below percentile score											
	10		21		31		50		65		93	
Def.	M	F	M	F	M	F	M	F	M	F	M	F
CUR	1.6	0.9	11.2	9.1	20.7	20.0	41.1	44.1	56.9	62.5	88.9	91.9
ALT1	0.3	1.2	6.2	13.2	14.1	27.8	31.2	54.2	46.9	72.7	83.7	98.4
ALT2	0.3	1.1	7.7	12.3	16.0	24.8	34.0	50.6	50.0	69.6	84.1	97.2
ALT3	0.4	0.8	7.8	11.3	17.7	24.8	35.1	48.4	50.6	67.0	85.3	95.9
ALT4	0.8	0.8	9.4	10.3	19.0	21.9	38.0	45.6	53.4	63.9	87.8	94.7
ALT5	0.8	0.8	9.7	10.1	18.3	21.1	38.0	47.3	52.1	63.6	86.8	94.3
ALT6	0.7	0.5	8.9	8.8	20.6	21.6	38.2	44.0	55.5	63.3	87.3	91.4
ALT7	1.2	0.8	9.4	9.1	20.1	21.5	39.6	45.6	54.4	62.2	88.1	93.4
ALT8	1.1	0.4	10.7	8.2	20.9	19.7	39.9	41.8	56.7	59.3	88.8	92.5
ALT9	0.8	0.5	9.7	8.6	20.4	21.4	38.2	44.1	54.8	61.9	87.6	94.4
ALT10	0.2	0.6	7.3	10.2	16.5	23.2	34.2	48.5	51.1	68.5	85.7	96.1
ALT11	2.3	3.3	8.1	12.0	16.5	22.8	36.4	47.8	52.9	63.6	83.4	94.5
ALT12	1.0	0.8	9.9	9.9	20.6	21.6	39.4	45.6	55.0	63.2	89.0	93.3
ALT13	0.9	1.2	9.3	10.7	18.9	23.4	37.2	47.2	52.5	65.9	87.6	95.2
ALT14	0.4	0.3	8.2	10.0	18.1	24.5	34.9	47.0	50.9	65.1	86.6	96.0
ALT15	0.7	2.9	5.7	16.5	10.8	29.4	27.2	58.4	40.8	74.0	83.9	99.0
ALT16	0.5	1.4	7.4	11.6	16.1	25.5	33.2	51.5	48.8	69.8	84.2	97.8
ALT17	0.4	1.4	6.5	12.4	15.3	26.9	32.5	52.4	47.6	70.0	84.6	98.5

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

Table C-2

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS
FOR 1980 YOUTH POPULATION WITH GT FILTER

Weighted N = 22,449,523
(2,118,675 Blacks and 20,330,848 Whites)

	Blacks and Whites - Percent scoring below percentile score											
	10		21		31		50		65		93	
Def.	B	W	B	W	B	W	B	W	B	W	B	W
CUR	3.6	1.0	29.4	8.2	51.9	17.1	79.5	38.7	89.5	56.6	99.0	89.5
ALT1	3.2	0.5	33.4	7.1	58.9	16.8	80.8	38.6	91.4	56.3	98.8	90.1
ALT2	2.6	0.5	33.1	7.6	53.9	16.8	79.6	38.3	90.6	56.4	98.8	89.7
ALT3	1.8	0.5	29.8	7.4	54.2	17.8	79.1	37.8	89.5	55.5	98.8	89.6
ALT4	2.4	0.6	28.4	7.9	50.6	17.3	76.4	38.2	87.5	55.6	99.1	90.4
ALT5	2.3	0.6	30.3	7.8	52.9	16.2	79.0	38.8	88.3	54.6	99.1	89.6
ALT6	1.4	0.5	27.3	7.0	53.1	17.8	76.7	37.3	88.8	56.3	98.9	88.3
ALT7	2.7	0.8	26.6	7.4	49.2	17.8	76.8	38.9	86.6	55.3	99.1	89.3
ALT8	1.7	0.7	24.5	7.9	47.5	17.4	71.9	37.6	83.4	55.3	98.4	89.8
ALT9	1.9	0.5	25.3	7.5	51.3	17.8	73.9	37.7	85.8	55.4	98.5	90.2
ALT10	1.0	0.3	29.7	6.6	53.9	16.3	80.3	37.2	91.6	56.3	99.3	90.0
ALT11	7.5	2.3	27.8	8.1	43.5	17.1	71.9	38.9	84.7	55.4	97.7	87.9
ALT12	2.2	0.7	29.5	7.8	51.7	17.9	78.1	38.7	87.9	56.0	99.1	90.3
ALT13	3.7	0.7	30.5	7.8	54.5	17.6	78.8	38.3	89.1	56.0	99.1	90.6
ALT14	0.8	0.3	26.9	7.2	53.2	17.9	76.1	37.2	88.0	54.8	99.1	90.4
ALT15	8.7	1.1	39.7	8.0	57.7	16.0	82.4	38.4	90.6	53.6	99.1	90.5
ALT16	3.9	0.6	30.8	7.3	56.2	17.0	79.5	38.3	90.0	56.0	98.7	90.1
ALT17	4.1	0.5	31.8	7.1	57.6	17.2	80.1	38.3	90.3	55.3	98.7	90.7

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

Table C-3

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS
FOR 1980 YOUTH POPULATION MALES WITH GT FILTER

Weighted N = 11,391,754
(1,020,237 Blacks and 10,371,517 Whites)

	Blacks and Whites - Percent scoring below percentile score											
	10		21		31		50		65		93	
Def.	B	W	B	W	B	W	B	W	B	W	B	W
CUR	4.2	1.4	29.3	9.4	51.5	17.7	78.4	37.5	87.9	53.8	98.5	88.0
ALT1	1.6	0.2	23.1	4.5	49.8	10.5	73.0	27.1	86.2	43.0	97.6	82.4
ALT2	1.5	0.2	25.9	5.9	47.9	12.8	73.8	30.1	86.3	46.5	97.4	82.8
ALT3	1.6	0.3	24.3	6.2	49.3	14.6	74.6	31.3	85.9	47.1	97.4	84.1
ALT4	2.7	0.6	25.9	7.7	48.6	16.1	73.5	34.5	85.0	50.3	98.1	86.8
ALT5	2.5	0.6	27.1	8.0	50.1	15.2	74.5	34.4	85.1	48.8	98.2	85.7
ALT6	1.6	0.6	24.7	7.4	51.1	17.7	73.1	34.7	86.4	52.4	98.0	86.3
ALT7	3.3	1.0	25.3	7.8	48.5	17.3	74.1	36.2	85.2	51.4	98.3	87.1
ALT8	2.5	1.0	24.7	9.3	47.4	18.2	70.6	36.9	83.1	54.1	97.9	87.9
ALT9	2.3	0.6	23.2	8.4	50.2	17.5	71.9	34.9	83.9	51.9	97.8	86.6
ALT10	0.8	0.2	24.9	5.6	48.2	13.4	74.2	30.3	87.9	47.5	98.6	84.5
ALT11	6.4	1.9	23.4	6.6	39.9	14.2	70.6	33.0	83.0	49.9	95.7	82.2
ALT12	2.6	0.8	27.7	8.1	50.6	17.6	75.2	35.9	85.7	51.9	98.3	88.1
ALT13	3.4	0.6	27.1	7.5	50.9	15.7	74.5	33.5	85.7	49.3	98.1	86.6
ALT14	0.6	0.3	23.9	6.6	48.0	15.2	72.0	31.3	83.9	47.6	98.2	85.4
ALT15	4.9	0.3	26.1	3.7	44.6	7.4	74.3	22.6	84.3	36.5	98.2	82.5
ALT16	2.4	0.3	24.5	5.7	50.3	12.7	72.8	29.3	85.3	45.3	97.3	82.9
ALT17	2.1	0.2	23.2	4.8	50.4	11.9	73.4	28.4	85.4	43.8	97.3	83.3

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS
ALT16 = WK + 2PC + AR + GS + MK + EI + AS
ALT17 = VE + AR + GS + MK + EI + AS

Table C-4

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS
FOR MARINE CORPS FY85 APPLICANTS WITH GT FILTER

N = 56,731
(51,484 males and 5,247 females)

Males and Females - Percent scoring below percentile score

	10		21		31		50		65		93	
Def.	M	F	M	F	M	F	M	F	M	F	M	F
CUR	0.0	0.0	2.8	0.5	11.7	5.1	47.2	25.1	68.4	56.6	96.2	95.4
ALT1	0.0	0.0	1.8	2.8	11.9	15.9	39.6	53.6	61.4	77.3	94.9	99.3
ALT2	0.0	0.0	2.3	2.0	12.0	11.5	41.5	45.2	63.7	72.2	95.1	98.5
ALT3	0.0	0.0	2.2	1.5	13.6	10.7	42.0	40.8	63.4	67.5	95.7	98.3
ALT4	0.0	0.0	3.1	1.2	13.9	8.5	44.4	35.5	65.3	62.7	97.2	98.1
ALT5	0.0	0.0	3.5	1.4	13.7	9.2	46.4	40.3	63.9	62.8	96.2	97.2
ALT6	0.0	0.0	2.7	0.8	15.4	8.8	45.9	34.0	67.8	62.9	96.3	96.2
ALT7	0.0	0.0	2.5	0.6	13.7	7.1	46.0	33.3	66.2	60.7	97.6	98.0
ALT8	0.1	0.0	4.0	1.2	17.0	7.8	46.9	33.8	67.3	58.8	96.2	96.2
ALT9	0.1	0.0	4.0	1.8	17.1	10.3	43.9	36.2	64.7	62.0	96.0	97.1
ALT10	0.0	0.0	1.3	0.6	12.8	10.6	42.1	42.0	64.7	70.4	95.5	98.1
ALT11	0.6	0.5	5.6	4.8	13.1	10.9	39.6	37.7	60.8	60.6	94.9	97.3
ALT12	0.0	0.0	3.0	0.8	14.7	7.9	46.7	34.0	67.8	63.1	97.6	97.9
ALT13	0.0	0.0	3.0	1.1	13.9	9.6	43.6	36.5	65.4	64.6	97.8	98.6
ALT14	0.0	0.0	2.4	1.5	15.6	11.7	42.8	41.5	63.7	67.4	95.3	98.1
ALT15	0.1	0.4	3.1	7.2	10.0	19.4	35.5	56.5	53.9	77.2	96.0	99.8

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS

Table C-5

DISTRIBUTIONS OF ALTERNATIVE AFQT DEFINITIONS
FOR MARINE CORPS FY85 APPLICANTS WITH GT FILTER

N = 56,731
(11,255 Blacks and 45,476 Whites)

	Blacks and Whites - Percent scoring below percentile score											
	10		21		31		50		65		93	
Def.	B	W	B	W	B	W	B	W	B	W	B	W
CUR	0.1	0.0	4.7	2.1	19.5	8.9	66.1	40.0	85.8	62.7	99.2	95.4
ALT1	0.0	0.0	6.0	0.9	31.0	7.6	72.6	33.1	89.3	56.3	99.6	94.2
ALT2	0.0	0.0	5.7	1.4	26.9	8.2	69.3	35.1	87.6	58.8	99.5	94.4
ALT3	0.0	0.0	5.1	1.4	28.5	9.5	68.4	35.4	86.5	58.2	99.6	95.0
ALT4	0.0	0.0	6.1	2.1	26.0	10.3	66.7	37.8	85.3	60.0	99.6	96.7
ALT5	0.0	0.0	7.3	2.3	27.1	9.9	71.3	39.5	85.9	58.3	99.5	95.5
ALT6	0.0	0.0	5.0	1.9	28.8	11.4	68.8	38.8	87.6	62.4	99.4	95.6
ALT7	0.0	0.0	4.5	1.8	24.0	10.3	66.3	39.5	84.9	60.9	99.6	97.1
ALT8	0.2	0.0	6.7	3.0	27.7	13.3	64.7	41.0	83.1	62.3	99.2	95.4
ALT9	0.2	0.0	7.7	2.9	29.7	13.1	64.5	37.9	83.4	59.7	99.4	95.2
ALT10	0.0	0.0	2.9	0.9	28.4	8.7	70.9	35.0	89.1	59.4	99.6	94.7
ALT11	1.4	0.4	10.8	4.2	23.0	10.4	58.1	34.8	78.7	56.3	99.1	94.1
ALT12	0.0	0.0	5.4	2.2	26.4	11.0	68.4	39.9	86.8	62.6	99.6	97.1
ALT13	0.0	0.0	6.3	2.0	27.4	10.0	68.6	36.6	87.0	60.0	99.7	97.4
ALT14	0.0	0.0	5.1	1.7	30.7	11.4	68.0	36.5	86.1	58.6	99.5	94.6
ALT15	0.6	0.1	11.2	1.6	30.2	6.1	72.8	28.6	87.6	48.2	99.8	95.5

CUR = VE + AR + NO/2
ALT1 = VE + AR + GS + MK + MC + EI + AS
ALT2 = VE + AR + GS + MK + MC + EI
ALT3 = VE + AR + GS + MK + MC
ALT4 = VE + AR + GS + MK
ALT5 = VE + AR + GS
ALT6 = VE + AR
ALT7 = VE + AR + MK
ALT8 = VE + MK
ALT9 = VE + GS + MK
ALT10 = VE + AR + MC
ALT11 = GS + MK
ALT12 = 2VE + 2AR + MK
ALT13 = VE + 2AR + GS
ALT14 = VE + MK + MC
ALT15 = AR + GS + AS

END

11-86

DTIC